Operating Manual

8 Cylinder TDI

Boat Engines from Volkswagen Marine

TDI 350-8

VOLKSWAGEN marine

You have decided on a VOLKSWAGEN Marine Boat Engine - Thank you for putting your trust in us.

VOLKSWAGEN Marine boat engines have been specially developped for use in boats.
VOLKSWAGEN Marine offers a wide model range to meet your specific requirement.

VOLKSWAGEN Marine boat engines are characterised by many advantages:

- ***Compact design and low weight create the conditions for universal installation.***
- ***A long life and low fuel consumption ensure economy and environmental friendliness.***

You have decided on a VOLKSWAGEN Marine boat engine that is advanced in every regard. Your boat engine has been developed to put the least possible strain on the environment.

VOLKSWAGEN Marine Service Partners are at your disposal to take care of your VOLKSWAGEN Marine boat engine.

The VOLKSWAGEN Marine Service Partner

The VOLKSWAGEN Marine Service Partners provide a competitive and professional service, with all work conforming to factory guidelines. They also ensure that your VOLKSWAGEN Marine boat engine is in complete working order. In addition, VOLKSWAGEN Marine Service Partners offer an extensive package of warranties and service offers.

VOLKSWAGEN Marine Service Partners will be happy to provide details on the services and possible developments in individual countries.

VOLKSWAGEN Marine

What you should know before you read this manual

This manual

contains important information on using your VOLKSWAGEN Marine engine. You should read this manual carefully before first use of your engine to quickly familiarise yourself with the engine and so that you know how to operate and handle it correctly.

In addition to regular care and maintenance, the proper treatment of the VOLKSWAGEN Marine engine helps preserve its value and is in many cases also one of the conditions for warranty claims.

Additional warranty information is contained in the service schedule.

For safety reasons, please observe the safety precautions on page 17 and the information on changes and parts replacement on page 19.

Supplied equipment

The supplied equipment described here is as complete as possible at the time of going to print. Some of the equipment may not be available until a later time.

Equipment marked with a * is not part of the standard equipment of VOLKSWAGEN Marine boat engines.

Environmental protection information

Text in italics marked with this symbol provides important information on environmental protection.

Contents

On the first pages you will find a table of contents that shows all topics described in this manual in the order of their occurrence.

Index

At the end of the manual an extensive, alphabetical index is provided.
With search terms you can specifically find the desired information.

Warnings

Warning

Texts written in this bold print and on this shaded background indicate the possible danger of accidents and injuries.

Text in this bold print indicates either risks that can lead to the marine engine being damaged, or indicates particularly important information on the proper use of your engine.

And finally, we have a request:

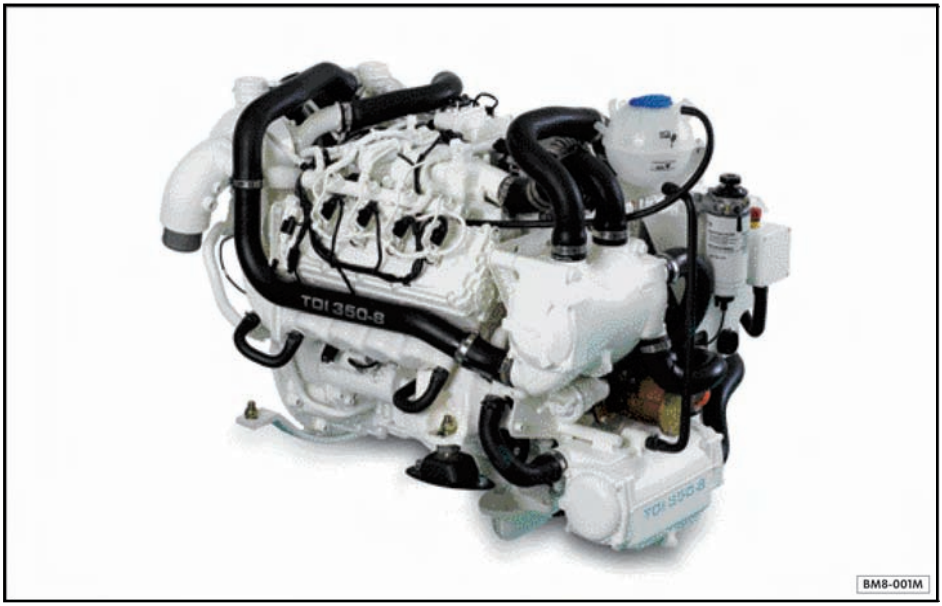
When selling your boat or your VOLKSWAGEN marine boat engine, please give this manual to the new owner, as the literature is part of the VOLKSWAGEN Marine boat engine.

Note
When your boat is craned or slipped, water can enter the exhaust system of your engine.
Make sure that the exhaust system of the engine is drained of any remaining water before craning or slipping to avoid damage.

CONTENTS

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines.

General view of engine



Engine description TDI 350-8

- Four-stroke diesel engine
- Common-rail direct injection
- V8 cylinder arrangement
- 4.2 litre displacement
- Crankshaft mounted on 4 bearings
- Valves control by chain connected to overhead cam
- Hydraulically adjusted bucket tappets
- Engine lubrication as forced-feed circulatory lubrication with geared oil pump and replaceable oil filter in main flow
- Dry air filter

The engine has two separate cooling circuits.

1 The open seawater circuit runs via the oil cooler, the main heat exchanger and the exhaust manifold.

2 The coolant circuit runs as a closed pressurised system through the engine block, oil cooler, exhaust collector, and, after reaching the operating temperature, via the main heat exchanger.

Warning

Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Starting the engine

Warning

- **Never start or operate the engine in an unventilated or enclosed space. The engine exhaust contains, amongst other gases, odourless and colourless carbon monoxide, a poisonous and life-threatening gas! Carbon dioxide can cause unconsciousness and death.**
- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**
- **Never start the engine when the throttle lever(s) has/have been removed.**

Risk of accident!

- When the throttle lever is correctly installed, the engine cannot be started unless the lever is in neutral position. This is indicated in your rev. counter display (**Neutral blinking**).
- Before starting the engine, check the motor oil-, coolant- and hydraulic oil levels, the fuel gauge and the seawater filter, and make sure that the seawater valve for the seawater cooling circuit supply is open.
- As soon as the engine starts, release the ignition key immediately, as the starter must not continue to run with the engine.
- When restarting the engine, restarting is not possible until the key has been completely turned back. The restarting-lock prevents the starter from engaging with the engine running, which could damage the starter.
- After starting a cold engine, increased running noises may occur for a brief period, as oil pressure must first build up in the hydraulic valve clearance compensation unit. This is normal and should thus be ignored.

Engine break-in

Even modern engines need a break-in period. Be careful to drive moderately until an optimum operating temperature of 90°C is reached and always avoid high rpm when the engine is cold.
Do not accelerate too fast at the beginning and drive moderately to break in the engine not exceeding 2/3 of the nominal rotation speed for approximately the first five hours.
After the approximate five-hour period you may gradually run up the rpm.
This is to ensure that the plain bearings of the engine all perfectly benefit from a proper engine break-in.
The result: frictional resistance, long-term wear, and oil and fuel consumption are significantly reduced whereas the engine service life is prolonged and the performance increases.
As a result of an improper break-in procedure, fuel and oil consumption will generally increase with normal service life accompanied by poor engine performance.

Switch off engine

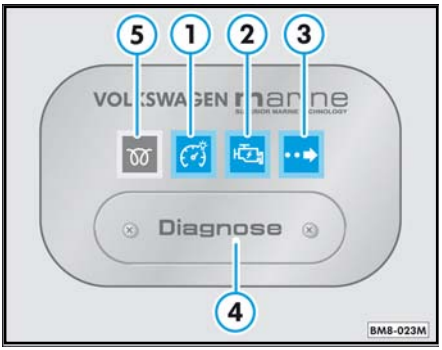
Following longer periods at high engine loads, do not switch off the engine immediately, but instead allow it to idle for approx. 2 minutes to prevent heat accumulation.

Warning

Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Instruments / Buttons

The figure shows the control unit buttons for the individual instrumentation.



1 - Control unit

Item

① **Button for dimmer regulation and instrument lighting**

The brightness of the instrument lighting can be adjusted by pressing the button.

② **Acknowledge button for acoustic signal**

The acoustic signal of a fault message can be acknowledged with this button.

③ **Button for multifunction display**

The multifunction display is operated with this button. Each time the button is pressed, the display in the MFD is advanced.

Note

A comprehensive instruction manual containing descriptions of the individual functions of the multifunction display is contained in the booklet

Additional operating manual for the multifunction display

④ **Access to diagnostic interface**

⑤ **without function**

Warning
Before mounting components of the individual instrumentation, please read the installation description.
It contains important safety instructions for mounting.
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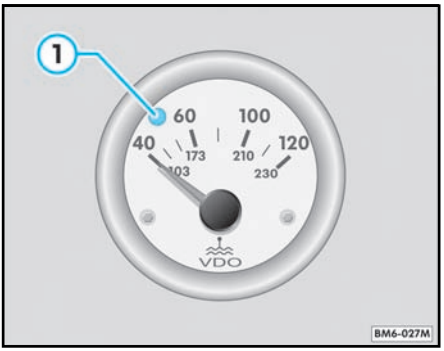


2 - Coolant temperature gauge

The gauge works once the ignition is turned on.

When the ignition is switched on, the warning lamp **-1-** lights up for a few seconds as an operating check.

Note

Avoid high engine speeds and do not subject the engine to heavy loading as long as the coolant temperature is still below 40 °C.

The needle should, during normal running, oscillate about the central scale area.

At heavy engine loads and high outside temperatures, the needle may also move far into the upper range.

This is not a cause for concern as long as the warning lamp -1- does not light up and the acoustic signal does not sound.

① - Warning lamp

Warning lamp **-1-** lights up when the coolant temperature is too high.

As an additional warning, an acoustic signal sounds at the same time, which can be switched off with the confirmation button **-7-** (see figure on page 12).
Should the fault not be cleared, the acoustic signal sounds again after a short time.

In this case, switch off the engine immediately and check whether ...

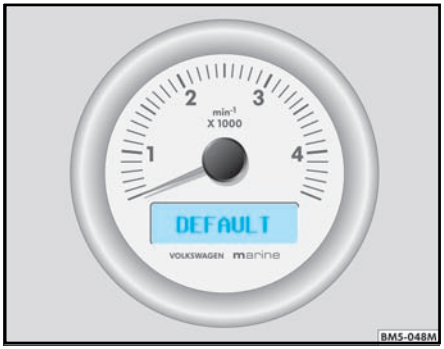
- the seawater filter is clogged.
- the seawater valve is open.
- sufficient coolant is present. Check the cooling system for leaks.
- The ribbed V-belt of the seawater pump is OK.
- The impeller of the seawater pump is OK -see page 50.

Please contact the nearest VOLKSWAGEN Marine Service Partner if the fault cannot be eliminated.

If the lamp lights up during running, first check the coolant temperature gauge.

If the gauge is in the normal range, coolant must be added as soon as possible.

If the needle is above 110 °C, the coolant temperature is too high. Stop the engine and determine the cause of the fault - see page 23.



3 - Rev. counter

Never run the cold engine at high speeds - either when idling or during running.

If the needle of the rev. counter goes above 4500 rpm, you should cut back on the throttle to prevent engine damage.

In the case of a system error the multi-function display of the rev.counter shows the message **-SERVICE-.**

If this message appears, the program stored in the engine control unit will enable you to safely continue your trip however if necessary with a reduced engine output.
Please contact a VOLKSWAGEN Marine Service Partner for system failure analysis and troubleshooting.

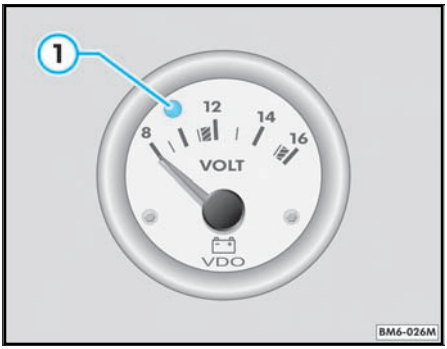
4 - Voltmeter

The voltmeter indicates the voltage in the electrical onboard supply. Normal value: between 12 and 16 volts. If the generator charging indicator lights up or the gauge drops below 12 volts with the engine running, have the power supply (battery and alternator) checked by a VOLKSWAGEN Marine Service Partner.

During starting, the indicated voltage can fall beneath 8 V.

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Warning lamps



5 - Alternator

The warning lamp **-1-** illuminates when the ignition is switched on. It must go out after the engine starts.

If the alternator warning lamp lilluminates during running:

- Switch off the engine immediately and check the ribbed V-belt.

If the ribbed V-belt is OK, the fault is probably in the alternator or the regulating switch. If the damage cannot be repaired, please contact the nearest VOLKSWAGEN Marine Service Partner.

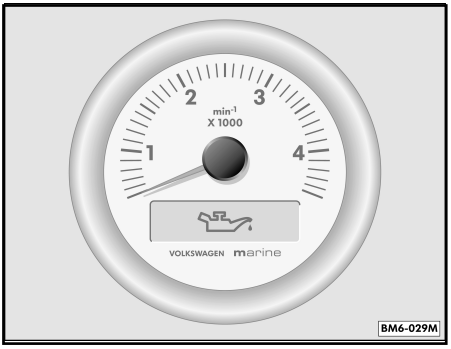
Note

The engine must not:

- **be operated with the battery disconnected, as otherwise the alternator will be damaged.**
- **operated without the alternator ribbed V-belt, as otherwise the front vibration damper will be damaged.**

Warning

Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.



6 - Engine oil pressure gauge

(installation optional)

The engine oil pressure gauge only functions with the engine running and indicates the existing engine oil pressure. During driving the engine oil pressure is between approx. 1 and 5 bar. At an engine oil pressure lower than 1 bar the engine oil pressure warning lamp can light up and an acoustic signal can sound.

If the engine oil-pressure warning lamp illuminates or flickers during operation:

- Switch off the engine immediately, as engine lubrication may be interrupted.
- Then check the engine oil level (see page 34).

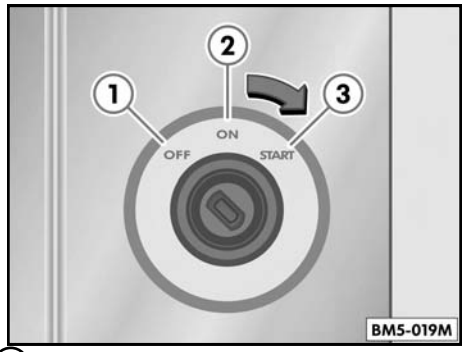
You can switch off the acoustic signal by pushing the acknowledgement key **-7-** (see page 12).

Should the fault not be eliminated, the acoustic signal sounds again after a short time.

Occasional flickering of the warning lamp at idle when the engine is warm is meaningless if the lamp goes out again when the engine speed is increased.

The oil pressure warning alamp is not an oil level display ! Therefore the oil level should be checked at regular intervals, preferably before each trip.

Ignition lock



1. **Fuel supply interrupted, engine off**
2. **Running position**
3. **Starting the engine**

Warning

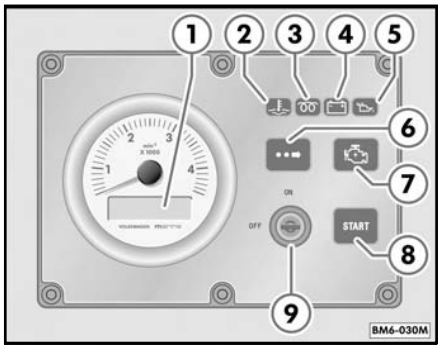
Always remove the ignition key if you leave the boat - even for a short time. This is particularly important when children remain in the boat. Otherwise they could start the engine or operate the electrical equipment. Risk of accident!

Emergency stop switch

An emergency stop switch with lanyard helps to prevent accidents. If there is an emergency situation with risk of endangering personal (man overboard), the complete power supply of the engine will be stopped immediately by pulling the lanyard. Therefore the installation and use is **stringently required** by VOLKSWAGEN Marine. An emergency stop switch must be located at **all** control panels (for further details please follow the "Installation description EB08", page 41).

To restart the engine, the toggle switch has to be moved back to the -**ON**-position.

Midi panel instrumentation *12*



As an alternative to the individual instrumentation, which is included in the delivery, a midi panel instrumentation* may be used instead.

Pos.

1. **Rev. counter with multifunctional display**
2. **Indicator light for coolant temperature**
3. **Indicator light for motor control**
4. **Indicator light for alternator**
5. **Indicator light for emgine oil pressure**
6. **Button for multifunction display**
7. **Acknowledgement button for acoustic signal**
8. **Start button**
9. **Ignition lock / Engine stop**

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines.

Warning

Before installing the midi panel instrumentation please read the installation description.

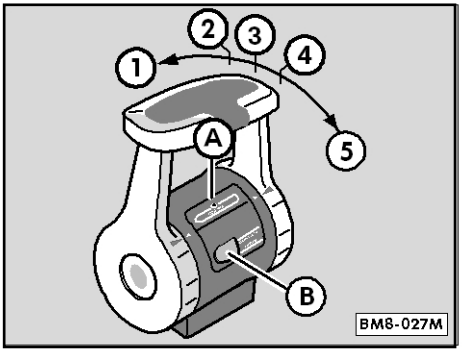
It contains important safety instructions concerning the installation.

Start button*

When midipanel instrumentation* is installed, the engine can be started using the start button* **-8-** (see figure above). Insert the ignition key in the ignition lock turn to the running position (see page 12). Press the start button to start the engine.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines.

Throttle lever function for a single-engine system



①- Forward direction
②- Shift to forward direction
③- Neutral
④- Shift to reverse direction
⑤- Reverse direction

Starting an engine with a <u>single</u> control stand

1 Switch the ignition on.

- You will hear a short acoustic signal and the throttle lever control light (see **Item A** on the illustration) flashes twice a second.

2 Make sure that the throttle lever is at neutral **-3-.**

3 Press the **-CONTROL-** button (see **Item B** on the illustration).
- The throttle lever control light **(Item A**) stays on.

4 Make sure that the message **-NEUTRAL-** appears in the multifunction display of the rev counter and that there is no signal flashing up.

5 Start the engine.

Throttle lever function for a single-engine system

Starting an engine with two control stands

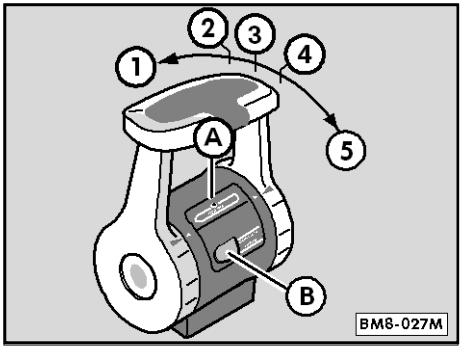
1. Switch the ignition on.

- You will hear a short acoustic signal and the throttle lever control light of the selected control stand (see **Item A** on the illustration) flashes twice a second.

2. Make sure that the throttle levers of both control stands are at neutral **-3-**.
3. Push the **-CONTROL-** button (see **Item** B) of the selected control stand.

- the throttle lever control light of the selected control stand stays on whereas the control light of the other control stand switches off.

4. Start the engine.



Control stand changeover

1. Make sure that the throttle levers of both control stands are at neutral **-3-**.
2. Press the **-CONTROL-** button of the control stand taking over.

- The throttle lever control light of the control stand taking over (**Item A**) stays on.
The control stand is now activated.

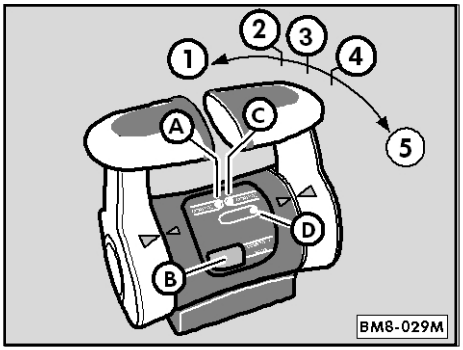
Speed setting with the gears in neutral

1. Make sure that the throttle lever is at neutral **-3-**.
2. Press the **-CONTROL-** button (see **Item B** on the illustration) and simultaneously set the throttle lever to position **-2-.**
3. Release the **-CONTROL-** button

- The control light (see **Item A**) continuously flashes twice a second.

4. You may now, with the gears in neutral, increase the speed as required (throttle lever positions **-2- to -1-**).
5. To terminate the function, set the throttle lever to neutral **-3-**. The control light stays on.

Throttle lever function for a two-engine system



Starting the engines with a single control stand.

Start the engines one after the other as described below:stand

1. Switch the ignition of the selected engine on.

- You will hear a short acoustic signal and the throttle lever control light of the selected engine (see **Item A or Item C** on the illustration) flashes twice a second.

2. Make sure that the throttle lever of the selected engine is at neutral **-3-**.
3. Press the **-CONTROL-** button (see **Item B** on the illustration).

The throttle lever control light **(Item A- or Item C-)** stays on

4. Make sure that the message **-NEUTRAL–** appears in the multi-function display of the rev counter and that there is no signal flashing up.
5. Start the engine.

Repeat steps 1. to 5. on the second engine.

Starting the engines with two control stands

Start the engines one after the other as described below:

1. Switch the ignition of the selected engine on.

- You will hear a short acoustic signal and the throttle lever control light of the selected control stand (see **Item A** on the illustration) flashes twice a second.

2. Make sure that the throttle levers of both engines are at neutral **-3-**.
3. Press the **-CONTROL-** button (see **Item B**) of the selected control stand.

- The throttle lever control light of the selected control stand stays on whereas the control light of the other control stand switches off.

4. Start the engine

Repeat steps 1. to 5. on the second engine.

Speed setting with the gears in neutral

1. Make sure that the throttle lever is at neutral **-3-**.
2. Press the **-CONTROL-** button (see **Item B** on the illustration) and simultaneously set the respective throttle lever to position **-2-** (ahead) or position **-4-** (astern).
3. Release the **-CONTROL-** button.

- The throttle lever control light (see **Item A**) continuously flashes twice a second.

4. You may now, with the gears in neutral, increase the speed as required (throttle lever positions **-2- to -1- or -4- to -5-**).
5. To terminate the function, set the throttle lever to neutral **-3-**.

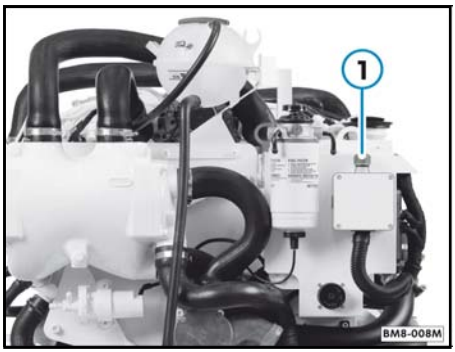
- The control light stays on.

Synchronous operation of two engines

Synchronous operation is possible from 5% to 95% of the set speed range. Provided that the throttle levers are not more than 10% apart from each other in this range, the synchronous operation lamp –**D**- (see fig. on page 15) lights up and the engines are controlled to run at synchronous speed.

The synchronization can be deactivated and activated again respectively by pushing the -**CONTROL**- button -**B**- (see fig. on page 15), provided that the button is pushed for a second and the above mentioned conditions are complied with.

Stop switch



You can stop the engine in case of danger using the stop switch -**1**- on the right-hand side of the central electrical unit.

After pressing the stop switch it must be unlocked again, as otherwise the engine cannot be started.

To release the stop switch, turn it in the direction shown by the arrow on the switch.

Safety precautions when working in the engine compartment

When performing any work on the engine or in the engine compartment, e. g. checking and topping up the operating fluids, there is a risk of scalding, injuries, accidents- and fire.

Warning
When carrying out any work on the engine or in the engine room use extreme care!
Protect yourself with suitable work clothing, e.g. gloves, eye protection etc.

- **Never open the engine compartment cover or perform work on the engine when you notice that water vapour or coolant is escaping - danger of scalding!**
  Wait until water vapour or coolant is no longer escaping and the engine has cooled down.
- **Stop the engine, remove the ignition key and press the Stop button.**
- **Move the throttle lever into the Neutral position.**
- **Allow the engine to cool.**
- **Keep children away from the engine compartment.**
- **Do not open the cap of the coolant reservoir while the engine is still at operating temperature, as the cooling system is pressurised.**
- **Never pour liquids over the hot engine. The liquids could ignite.**

If work on the electrical system is necessary:

- **Never conduct fault finding with the engine running - danger to life and limb!**
- **If work on or repairs to the electrical system are not carried out properly or professionally, other areas in the on-board electrical system could also be damaged - risk of accident and fire!**

- **Avoid short circuits in the electrical system, and in particular at the battery.**
- **If maintenance, testing, repairs or adjustments must be carried out with the engine running, there is an additional danger from rotating parts, e. g. ribbed V-belt and alternator. Danger to life and limb!**

Please also observe the warnings on the following page.

- If work on the fuel system or the electrical system is required:
  - Always disconnect the battery from the engine.
  - Do not smoke.
  - Never work near to an open flame.
  - Always have a fire extinguisher at the ready.

Avoid contact with operating materials. Should operating materials get into the eyes, flush the eyes immediately with clean water and see a doctor at once. Take the original operating material container with you to the doctor in these cases. You should be particularly aware of the following when you want to carry out work on open water:

- Swell could cause you to become unbalanced.
- The risk of spilling operating materials is increased by swell.
- If you require a doctor in an emergency, there will be a delay.

The warnings in this manual and the generally applicable safety rules must be observed.

When topping up fluids, make sure that they are not confused, as otherwise serious malfunctions and engine damage will result.

To ensure that leaks are detected in due time, the bilge under the engine should be kept clean and should be checked regularly. If soiling by oil or other operating fluids can be seen there, the engine should be checked by a VOLKSWAGEN Marine Service Partner.

Important note

Of course, coolant additives and motor oil are, of course, under constant development. Therefore this information only reflects the status at the time of printing. VOLKSWAGEN Marine Service Partners will always be kept up to date with any changes by the factory. Therefore, it is best to have operating materials changed by a VOLKSWAGEN Marine Service Partner.

Diesel

Diesel used must comply with DIN EN[1] 590 .

CN[2] not lower than 51.

Notes on the fuel system

During the installation of fuel system components, it has to be made sure that **non-ferrous metals such as copper lines, brass nipples or galvanized tanks are not used.**
The use of non-ferrous metals may result in a **power loss of the engine or failure of the injection nozzles.**

Winter operation

When using summer diesel, malfunctions may occur when exterior temperatures fall below 0 °C, as the fuel becomes too thick due to paraffinĆseparation.

In Germany "winter" diesel fuel is readily available from roadside petrol stations during the cold season and - dependent on fuel brand - is safe for operation at approximately -15 °C to -22 °C.

In countries with other climatic conditions, diesel fuels with a different temperature behaviour are offered.

The addition of petrol (gasoline) or other substances will cause severe damage to the engine and is therefore strictly forbidden.

Biodiesel must not be used.

1) **E**uro**S**tandard

2) **Ce**tane-**N**umber. Measure of the ignitability of diesel fuel.

Changes and Parts

Do not change the as-supplied condition of VOLKSWAGEN Marine boat engines without careful consideration. Therefore, if technical changes are to be made to the engine, or if parts must be renewed later, the following instructions must be observed:

- BEFORE purchasing parts and before making technical changes, a consultation with a VOLKSWAGEN Marine Service Partner should always take place because VOLKSWAGEN Marine Service Partners are well qualified to advise in these matters due to their close cooperation with us.

Warning

- **In your own interest we recommend using only genuine VOLKSWAGEN Marine parts for your VOLKSWAGEN Marine boat engine. The reliability, safety and suitability of these parts especially for the boat engine is ensured.**
- **Despite ongoing observation of the market, we cannot evaluate or provide any form of guarantee for other products, even if in isolated cases an approval by an officially recognised technical testing and monitoring association or a government approval has been granted.**
- **Other products can have a negative effect on the service life of your VOLKSWAGEN Marine boat engine.**

Self-help

● Genuine VOLKSWAGEN Marine parts are available from a VW Marine Service Partner. Obviously they will also be able to ensure installation is carried out correctly.

● If modifications are carried out, always observe our specifications. This ensures that no damage to the engine occurs, operating safety is maintained and the changes are permissible. A VOLKSWAGEN Marine Service Partner will also carry out this work correctly or refer you to a specialised workshop in special cases.

The broad network of VOLKSWAGEN Marine Service Partners with trained professionals, modern equipment and all required special tools is available to you for the care and service of your VOLKSWAGEN Marine boat engine.
Here you will receive professional advice and find fast, effective help.

If, for example, the engine should fail to start or idling faults occur, faults and their remedies are described in detail in the following chapter. Should the individual remedies not solve the problem, your VOLKSWAGEN Marine Service Partner will be happy to provide additional assistance.

If repairs must be made, the engine should be brought to a VOLKSWAGEN Marine Service Partner. It is in good hands there.

Warning

Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Note

To find your local VOLKSWAGEN Marine Service Partner, visit our website at

www. volkswagen - marine.de.

If you have special questions, please do not hesitate to contact our free of charge Service Hotline at 0800-89 62 74 63 or 0800-VWMARINE. We will be more than happy to help you in any way we can.

Fault	
Engine does not start	
Starter does not turn	
Cause	**Remedy**
Throttle lever is not in neutral position	Move throttle lever into neutral
Throttle lever neutral switch does not generate an output signal (only with Z drive)	Check operation of neutral switch
Neutral switch in gearbox does not output a signal (only with ZF reverse gearbox)	Check operation of neutral switch
Stop switch activated	Unlock stop switch
Ignition switched off	Switch on ignition
Battery discharged or defective	Check battery and charge; replace if necessary
Starter connections loose or corroded	Check connections and clean or replace if necessary
Connections to ignition/starter switch loose or corroded	Check connections and clean or replace if necessary
Air inside fuel system	See section on fuel system

Should the individual remedies not solve the problem, your VOLKSWAGEN Marine Service Partner will be happy to provide additional assistance.

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Fault	
No or faulty fuel supply	
Cause	**Remedy**
Fuel cock closed	Open fuel cock
No fuel in tank	Fill tank
Tank dirty	Clean
Fuel lines clogged	Check lines and clean if necessary
Water level in circulation filter* too high	Drain water from circulation filter*
Circulation filter* clogged	Clean circulation filter* and replace if necessary
Water level in fine element fuel filter too high	Drain water from fine element fuel filter
Fine element fuel filter clogged	Replace fine element fuel filter
Engine shakes	
See section on fuel supply	
Engine dies	
See section on fuel supply	

Should the individual remedies not solve the problem, your VOLKSWAGEN Marine Service Partner will be happy to provide additional assistance.

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines

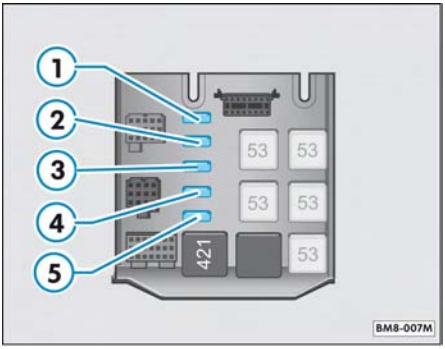
Fault **Engine becomes too hot**	
Cause	**Remedy**
Seawater valve closed	Open seawater valve
Seawater filter is clogged	Close seawater valve and clean seawater filter.
Seawater pump aspirates air	Check cover of seawater filter for proper seating and leaks and check suction hose.
Oil cooler clogged	Check oil cooler, clean if necessary
Impeller of seawater pump defective	Renew impeller
Insufficient coolant in cooling system - engine circuit	Add coolant (pure water in an emergency). Check cooling system for leaks and seal if necessary.
Coolant pump for engine circuit defective	This fault should always be checked and eliminated by a VOLKSWAGEN Marine Service Partner, as special tools are required.

Should the individual remedies not solve the problem, your VOLKSWAGEN Marine Service Partner will be happy to provide additional assistance.

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines

Fuses



The individual circuits are protected by fuses.

It is advisable to always carry a few replacement fuses available from VOLKSWAGEN Marine Service Partners.

Warning

- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**
- **Never "repair" fuses or replace with fuses of a higher amperage, as this may result in damage at another point in the electrical system. It may even cause a fire.**

Note

If a recently fitted fuse blows again after a short time, the electrical system must be checked as soon as possible by a VOLKSWAGEN Marine Service Partner.

The fuses are located in the central electric unit behind the cover (fig. BM8-004M), as well as on the rear side of the control unit of the individual instrumentation (fig. BM6-023M, page 25).

In the case of a two-engine system, the central electrical system shown in illustration BM8-004M is applied.
The circuit board presented in illustration BM8-007M is provided in duplicate where the boards are mounted side by side with this type of central electrical system.

Changing a fuse in the central electric unit

- Switch off the ignition and the affected consumer.
- Press down the Stop switch on the central electric unit (see fig. on page 16).
- Unscrew the screws and remove the cover from the central electric unit.
- Determine which fuse belongs to the failed consumer using the fuse table.

Fuse assignment

No.	Consumer	A[1)]
①	Main fuse	20
②	Oil extraction pump	5
③	Terminal 15 (ignition on)	15
④	Accessory (ignition on)	5
⑤	Accessory (permanent positive)	5

[1)] Amps

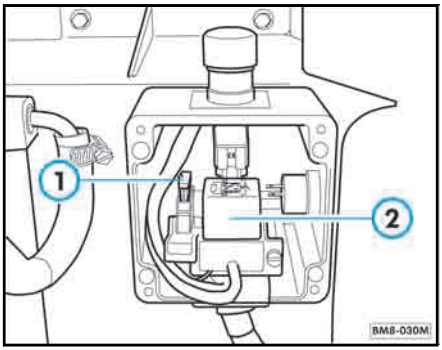
Fuses

Colour code for fuses:

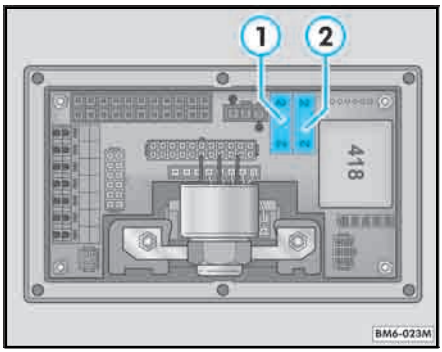
orange: ..... 5 amps
blue: ..... 15 amps
green: ..... 30 amps

- Pull out the appropriate fuse.
- Replace blown fuse (recognisable by melted metal strip) with a new fuse **of the same** rating.
- Secure the cover of the central electric unit again with the screws.
- Unlock the Stop switch.

Relaybox



1 - Main fuse (terminal 30) 30 amps
2 - Main relay



Changing a fuse in the control element of the individual instrumentation

- Switch off the ignition and the affected consumer.
- Press down the Stop switch on the central electric unit.
- Loosen the screws and pull the control unit off in a forwards direction.
- Determine which fuse belongs to the failed consumer using the fuse table.

Fuse assignment

No.	Consumer	A[1)]
1	Ignition on (terminal 15)	2
2	Permanent positive (terminal 30)	2

- Pull out the appropriate fuse.
- Replace blown fuse (recognisable by melted metal strip) with a new fuse **of the same** rating.
- Replace the control element and tighten the screws again.
- Unlock the Stop switch.

[1)] Amps

Service and care

The broad network of VOLKSWAGEN Marine Service Partners with trained professionals, modern equipment and all required special tools is available to you for the care and service of your VOLKSWAGEN Marine boat engine.

If an inspection service is required, all checking and adjustment to be carried out in this context are described in detail in the following chapter.

Some of the work must be carried out prior to each engine start..

Other work is only required on an annual basis, at the end of the season or after 200 operating hours.

The work described here is used to maintain your VOLKSWAGEN Marine boat engine.

The specified service intervals are matched to normal operating conditions.

Under **more extreme conditions** it is necessary to have some work carried out before the next service is due or between the specified service intervals. This applies above all to the cleaning of the air filter element when operating in very dusty conditions.

Start of Season

Work at start of season

At the start of the season, visually check and inspect the engine.

You should have the service work on your VOLKSWAGEN Marine boat engine conducted by your VOLKSWAGEN Marine Service Partner, as the work requires specialised knowledge and special tools.

Scope of work	Page
Ribbed V-belt for alternator, power steering pump: check condition	48
Toothed belt for common rail injection system: check condition	48
Check operation of seawater valve*	
Check battery voltage and charge battery* if necessary	52

Note

Maintenance must be performed on the reverse gearbox or the Sterndrive in accordance with the specifications of their respective manufacturers.

Warning

Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines

Daily checks

Visual inspection before each sailing

Before sailing check and visually inspect the engine.

Scope of work	Page
Visual inspection for leaks and damage	
Check engine oil level	32
Check circulation filter* (bowl) and drain off water if necessary	36
Check coolant level and top up if necessary	43
Check seawater filter* and clean if necessary	40
Check hydraulic oil level* for Sterndrives	47
Check reverse-gearbox oil level	46

Note

Maintenance must be performed on the reverse gearbox or the Sterndrive in accordance with the specifications of their respective manufacturers.

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines

End of season

Work at end of season

At the end of the season you should subject the engine to a check and visual inspection.

You should have the service work on your VOLKSWAGEN Marine boat engine conducted by your VOLKSWAGEN Marine Service Partner, as the work requires specialised knowledge and special tools.

Warning

- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**
- **Please be sure to observe the working sequences and information on engine preservation from page 53.**

Scope of work	Page
Visual inspection for leaks and damage	
Interrogate fault memory of engine electronics	
Change engine oil and oil filter	33,35
Replace fine element fuel filter	39
Check air filter element and clean if necessary	41
Check seawater filter* and clean if necessary	40
Check coolant level and top up if necessary	43
Seawater pump: Check impeller and replace if necessary	45
Check sacrificial anode and replace if necessary	46
Clean engine and carry out preservation measures	53
Flush and drain seawater cooling system	54
Fill fuel tank until full	

Note

Maintenance must be performed on the reverse gearbox or the Sterndrive in accordance with the specifications of their respective manufacturers.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines

Service scope
once a year or every 200 operating hours

Your VOLKSWAGEN Marine boat engine must be serviced once a year at the end of the season or every 200 operating hours.

You should have the service work on your VOLKSWAGEN Marine boat engine conducted by your VOLKSWAGEN Marine Service Partner, as the work requires specialised knowledge and special tools.

The following table shows the work required.

Scope of work	Page
Visual inspection for leaks from above and below	
Interrogate fault memory	
Change engine oil	33
Replace oil filter element	35
Replace circulation filter element*	37
Replace fine element fuel filter	39
Check power steering hydraulic oil level* for Sterndrive engines	47
Check coolant level	43
Check air filter element and clean if necessary	41
Ribbed V-belt for alternator, power steering pump: check condition	48
Toothed belt for common rail injection system: check condition	48
Clean seawater filter*	40
Seawater pump: Check impeller and replace if necessary	45
Check sacrificial anode and replace if necessary	46

Note

Maintenance must be performed on the reverse gearbox or the Z-drive in accordance with the specifications of their respective manufacturers.

Warning

Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines.

Additional work every 1,000 operating hours

This additional work on your VOLKSWAGEN Marine boat engine must be carried out every 1,000 operating hours.

You should have the additional work on your VOLKSWAGEN Marine boat engine conducted by your VOLKSWAGEN Marine Service Partner, as the work requires specialised knowledge and special tools.

The following table shows the scope of the additional work.

Scope of work	Page
Clean air filter element	41
Check pipe bundles of heat exchanger; remove and clean if necessary	

Note

Maintenance must be performed on the reverse gearbox or the Sterndrive in accordance with the specifications of their respective manufacturers.

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Additional work every 5 years or every 3,000 operating hours

This additional work on your VOLKSWAGEN Marine boat engine must be carried out every 5 years or every 3,000 operating hours.

You should have the additional work on your VOLKSWAGEN Marine boat engine conducted by your VOLKSWAGEN Marine Service Partner, as the work requires specialised knowledge and special tools.

The following table shows the scope of the additional work.

Scope of work	Page
Replace toothed belt for common rail injection system	

Note

Maintenance must be performed on the reverse gearbox or the Sterndrive in accordance with the specifications of their respective manufacturers.

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Engine oil

Specifications

A special VOLKSWAGEN Marine longlife oil that can be used all-year round is used to fill the engine at the factory.

It has special corrosion protection properties to protect the engine in an aggressive environment such as salty sea air. It also protects the engine from inner corrosion during long downtimes, e.g. during winter storage.

The container must be labelled with the specifications given on this page.

Important note

Obviously, engine oils are under constant development. Therefore, the information in this manual can only reflect the status at the time of printing.

VOLKSWAGEN Marine Service Partners are always kept up to date with any changes by the factory. Therefore, it is always best to have the oil change carried out by a VOLKSWAGEN Marine Service Partner.

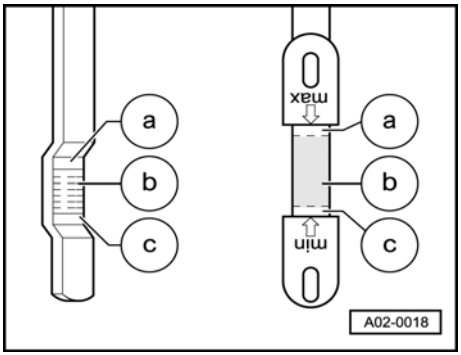
Multigrade light oil:

Specification VOLKSWAGEN Longlife VW 507 00

Important notes

- **The engine oil named above is a specified for the given maintenance intervals. Only this oil should be used for topping up.**
- **Avoid mixing with other oils, as otherwise the condition for the maintenance intervals specified in the service schedule will no longer be met.**

Checking engine oil level



During normal running, the engine consumes oil. Therefore, the engine oil level must be checked at regular intervals.

Conditions for checking the oil level

- Engine oil temperature must be at least 60 ^{0}C
- The boat must be at rest when measuring the oil level.
- Wait a few minutes after switching off the engine to permit the oil to run back into the oil pan.

Sequence of work

- Pull the dipstick out, wipe it with a clean cloth and push the dipstick back again into the tube making sure that it goes all the way in.
- Pull the dipstick out again and check the oil level.

Using the markings on the dipstick as an indicator

a – Oil **must not be** added.
b – Oil **can be** added.
c – Oil **must be** added.

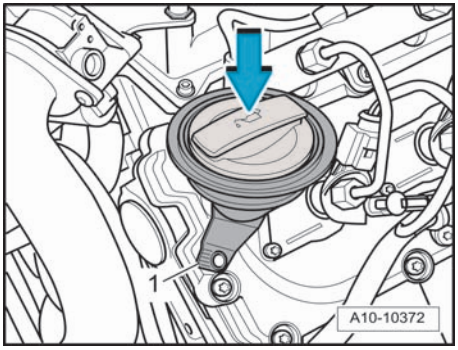
Sufficient oil is provided if the oil level is thereafter within the –**b**- range (serrated area).

Note
The oil level must not exceed the **max** mark –**a**- and must not be below the **min** mark –**c**-.

In the case of heavy engine loading, such as during longer engine operation (10 - 12 hours), the oil level should at least lie in the middle of the two markings (**min**/**max**).

The quantity difference between min. and max. marks is 1.3 litre..

Refilling engine oil



Remove the cap of the oil filler neck –**arrow**- and pour in small quantities of engine oil. Make sure that you also check the oil level by using the dipstick.

The oil level must never be above range A (see figure on page 34). Otherwise oil may be sucked via the crankcase ventilation.

Warning

When topping-up, do not allow any oil to fall onto hot engine components - risk of fire.

Carefully close the oil filler cap and push the dipstick in as far as the stop. Otherwise, oil could escape with the engine running.

Warning

Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Engine oil renewal

The properties of VOLKSWAGEN Longlife oil not only worsen due to loading during operation, but also due to ageing. The oil change date is therefore dependent on both the mileage and the running time.

If the engine is constantly operated under extreme operating conditions, the motor oil should be changed at shorter intervals.

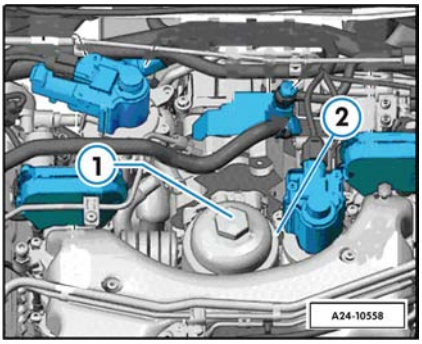
The motor oil must be changed at the intervals specified on page 29 and 30. Have the oil change carried out by a VOLKSWAGEN Marine Service Partner.

Warning

If you want to change the motor oil yourself, then please be sure to observe the following points:

- **To prevent the risk of burns from hot motor oil, allow the engine to cool first.**
- **Use a suitable container of a sufficient size to hold the oil filling quantity of your engine when draining the oil.**
- **Wear eye protection.**
- **If your hands come into contact with motor oil, they must then be washed thoroughly.**
- **Used oil must be stored in a safe place away from children until its proper disposal.**

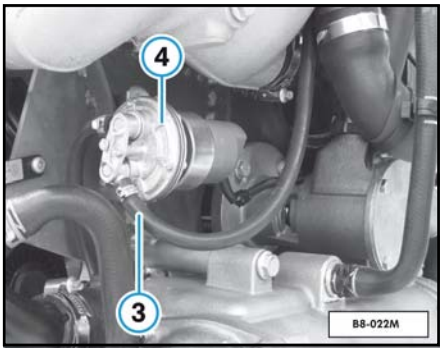
Engine oil renewal

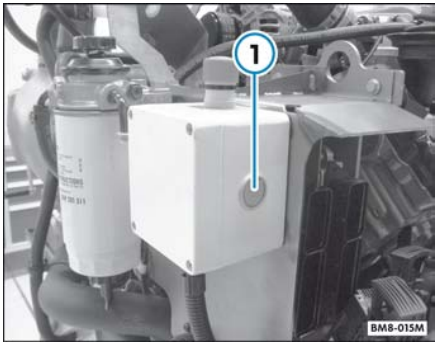


● Loosen the protective cap -**1**- of the oil filter housing -**2**- (see illustration above) using a 32 mm socket wrench, so that the return valve opens and the used oil can flow back into the oil sump.

● The supplied oil change hose -**3**- is already connected on to the union of the oil extraction pump -**4**- (see illustration below) .

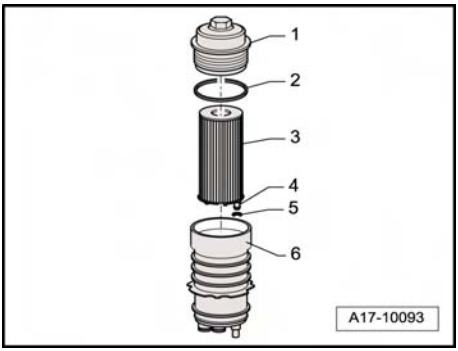
● Route the other end of the hose into the container being used for the oil change.





● With the engine stopped and the ignition switched on, press and hold the button -**1**- at the right front side of the engine and wait until the engine oil has been fully extracted

Replacing the oil filter element



● Loosen the protective cap -**1**- of the oil filter housing -**6**- (see illustration above) using a 32 mm socket wrench and remove the cap together with the filter element -**3**-.

● Remove the filter element -**3**- from the cap -**1**- and wipe the cap with a clean cloth

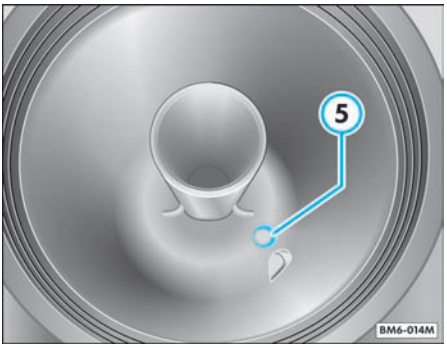
● Replace the filter element -**3**- and the gasket -**2**- and lightly coat the new gasket with oil.

● Replace the O-ring -**5**-.

● Fit the cap -**1**- together with the new filter element -**3**- into the oil filter housing and tighten the cap with a tightening torque of 35 Nm.

When proceeding with the fitting make sure that the neck – 4-, below at the oil filter element, is inserted into the respective drilling -5- of the oil filter housing (see fig. right).

● Use a 32 mm socket wrench to tighten the cap.



For filling quantities see the chapter "Technical data".

Check the oil level with the oil dipstick - also see page 34.

The oil level must be between the two markings and should never be above the max. mark.

Warning

Used oil must be stored in a safe place away from children until its proper disposal.

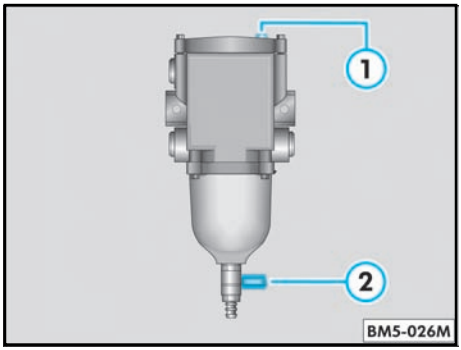
Oil must never get into waterways, the sewer system or the ground. Due to the disposal problem, it is best to have the motor oil and filter change carried out by a VOLKSWAGEN Marine Service Partner.

Engine oil additives

Do not mix additives with the engine oil.

Damage resulting from the use of such additives, will not be covered by the guarantee.

Circulation filter* water drainage



Warning
If you wish to change the circulation filter element*, always follow the guidelines and instructions provided by the manufacturer as well as the following notes.

- **Close the cut-off valve if present. If the engine is equipped with a single filter, switch off the engine. With a double filter it is sufficient to switch over to the other filter.**

- **Please make sure that no diesel fuel gets onto the hoses. Clean hoses immediately if necessary.**
- **Wear eye protection.**
- **If your hands come into contact with diesel fuel, they must then be washed thoroughly.**
- **The used circulation filter element must be stored in a safe place away from children until its proper disposal.**
- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**

Back-flushing

- Switch off the engine (single filter) or switch over to the second filter (double filter).
- Unscrew the bleeder screw -**1**-.
- Open the drain valve -**2**- below the bowl and catch fuel in a suitable container until all dirt is rinsed out of the bowl.
- Close the drain valve -**2**-.
- Pour clean fuel into the filter via the bleed hole.
- Screw the bleed screw -**1**- back in.
- Start the engine and conduct a visual inspection of the fuel system for leaks.

Notes

- After draining the fuel it is not necessary to bleed the fuel system.
- Should a loss of power or excessively high intake resistance not be eliminated by back-flushing, the filter element must be replaced.

Diesel fuel must never get into waterways, the sewer system or the ground.
Due to the disposal problem, it is best to have the filter change carried out by a VOLKSWAGEN Marine Service Partner.

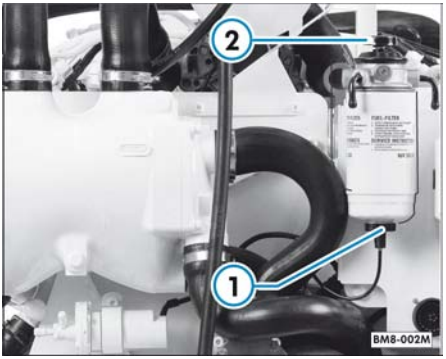
* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines

Replacement of circulation filter element*

Warning

If you wish to change the circulation filter element, always follow the guidelines and instructions provided by the manufacturer.

Fine element fuel filter water drainage



- Open the drain screw -**1**- (see fig. above) by a few turns and catch about 100 cm^3 fuel in a suitable container.
- Screw the bleed screw -**1**- back in.

Fine element fuel filter water drainage

Warning

If you want to drain the water from the fine element fuel filter, then please be sure to observe the following points:

- **Please make sure that no diesel fuel gets onto the coolant hoses. Clean hoses immediately if necessary.**
- **Wear eye protection.**
- **If your hands come into contact with diesel fuel, they must then be washed thoroughly.**
- **Used fuel must be stored in a safe place away from children until its proper disposal.**
- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**

Note

After draining the water from the fine element fuel filter it is not necessary to bleed the fuel system.

- The fine element fuel filter provides a hand pump -**2**- (see fig. above).

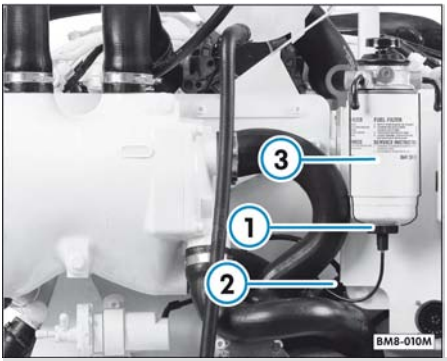
After draining the water from the fine element fuel filter, pump it until you detect an increased resistance. The fuel system has been filled with diesel.

Finally, visually check the fuel system for leaks.

Diesel fuel must never get into waterways, the sewer system or the ground.

Due to the disposal problem, it is best to have the filter change carried out by a VOLKSWAGEN Marine Service Partner.

Replacement of fine element fuel filter



Warning

If you want to change the fine element fuel filter yourself, then please be sure to observe the following points:

- **Please make sure that no diesel fuel gets onto the coolant hoses. Clean hoses immediately if necessary.**
- **Wear eye protection.**
- **If your hands come into contact with diesel fuel, they must then be washed thoroughly.**
- **The old fine element fuel filter must be stored in a safe place away from children until its proper disposal.**
- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**

- Remove the connector -**2**-.
- Unscrew the old fine element fuel supply filter -**3**- and clean the sealing surface of the bracket
- Empty the fine element fuel supply filter into an appropriate container and unscrew and remove the drain plug -**1**-.
- Remove the drain plug of the new fine element fuel supply filter and make sure to replace it with the drain plug of the old filter
- Lightly coat the rubber ring of the new fine element fuel supply filter with diesel fuel.
- Fill the fine element fuel filter with clean diesel. This enables the engine to be started more quickly.
- Screw in the new filter and **finger-tighten** it
- Fit the connector -2- back in

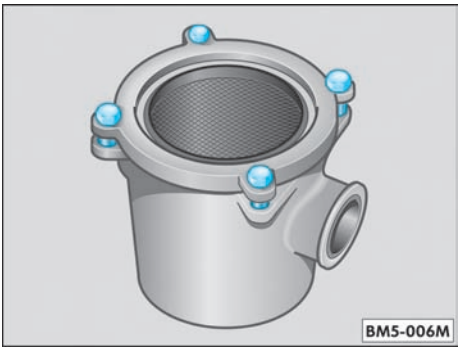
Note

After replacing the filter element it is not necessary to bleed the fuel system.

- The fine element fuel filter provides a hand pump. After changing the fine element fuel filter, pump it until you detect an increased resistance. The fuel system has been filled with diesel.
- Finally, visually check the fuel system for leaks.

Diesel fuel must never get into waterways, the sewer system or the ground.
Due to the disposal problem, it is best to have the filter change carried out by a VOLKSWAGEN Marine Service Partner.

Cleaning of seawater filter*



Warning

- **Never open the filter housing with the seawater valve open to prevent water from entering.**
- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**

As the degree of soiling of the seawater filter is depending on the water the engine is operated in, you should check the filter for soiling each time before starting the engine. As the cover of the filter housing is transparent, you do not need to open the cover.

If you detect soiling, proceed as follows:

- Close the seawater valve.
- Unscrew the screws -see left figure- and remove the cover.
- Remove the filter element, flush it thoroughly with clean water and refit it.
- Before screwing on the filter cover, the sealing ring should be lubricated, e.g. with silicone oil or Teflon spray.
- Check the cover and the gasket for correct seating.

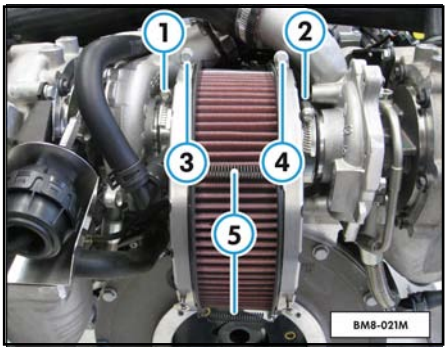
Warning

If a cover is not seated correctly, air can be sucked in, causing the engine to overheat.

- Open the seawater valve again.
- Start the engine and conduct a visual inspection of the seawater filter* for leaks.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines.

Air filter cleaning



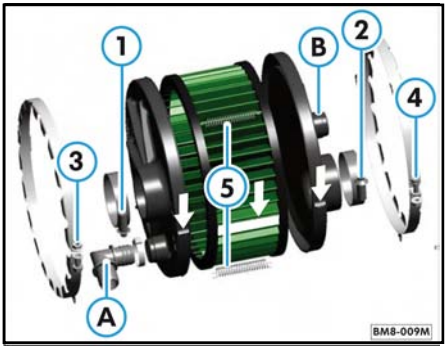
The air filter must be regularly cleaned. A dirty air filter can be detected in that the dirt particles will have settled in the small openings of the filter (see figure).

If the engine is operated in very dusty areas, clean the filter more frequently.

Removing the air filter

- Remove the two hoses of the crankcase ventilation system **-A-** and **-B-** at the left and right protective cap of the air filter.
- Loosen the hose clips **-1-** and **-2-** (see top left and top right illustration) and pull the two protective caps of the air filter together with the air filter off the intake pipes of the two turbochargers.
- Loosen the two mounting screws **-3-** and **-4-** at the metal rings and remove the tension springs **-5-** from the metal rings (4x).
- Remove the metal rings from the protective caps.
- Remove the caps from the air filter.
- Blow-out the filter from the inside towards the outside with **max. 2.0 bar compressed air**.

Air filter blow-out and washing



Warning

- **Wear protective goggles when blowing out the filter. Flying dirt particles can enter the eyes -risk of injury.**
- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**

- Clean the filter as described in the instructions on the special cleaning and service kit available from a VOLKSWAGEN Marine Service Partner.

Note

Never use petrol, thinner or other agents for cleaning! The filter could be destroyed.

Installing the air filter

Installation of the air filter is carried out in reverse sequence

Warning

When installing the protective caps make sure that the marking at the rim of the caps is properly aligned with the silver metal strip of one of the air filter ribs. (see - arrows). Arrange the mounting screws of the metal rings in such a way that the screwed connection is also aligned with the marking. This is necessary to ensure that the two protective caps are fitted to the intake pipes of the two turbo chargers.

Cooling system

The cooling system must be filled with a mixture of water and our coolant additive **G12++** (corrosion inhibitor and ethylene-based antifreeze) at a ratio of 60% (water) to 40% (coolant additive).
This ratio provides the necessary antifreeze protection down to approx. -25°C and, most of all, protects the light metal components of the cooling system against corrosion. In addition to this, scale deposits are avoided and the boiling point of the coolant is significantly increased.

Therefore, even in summer or in warmer countries, the water/additive ratio must not be changed by refilling the system with water. **The coolant additive portion must always be at least 40%.**
For climatic reasons, the **G12++** portion may be increased to 50% (antifreeze protection down to about -35°C).
An increase to 60% coolant additive content provides antifreeze protection down to -50°C.

Caution

The less water and the higher the coolant additive portion in the system, the higher the danger of a heat build-up. Beginning at a coolant additive portion of around 65%, antifreeze protection deteriorates dramatically. The result is an erratic temperature rise in the system, as the heat conductivity of the coolant drops extremely.

Coolant loss

Coolant loss is mainly a result of leakages. In such an event, the cooling system should be inspected immediately by a VOLKSWAGEN Marine Service partner. It is not sufficient to just add coolant.

With the system sealed, coolant losses will only be experienced when the coolant boils as a result of overheating and is then pressed out of the system.

Coolant additive

Only our **G12++** (corrosion inhibitor and ethylene-based antifreeze) or an additive with the specification TL 774-F (N 052 774 F0, check the description on the container, bottle or drum) must be used as coolant additive. The coolant additive is available from VOLKSWAGEN Marine Service Partners.
Any other coolant additive may considerably influence the corrosion protection effect.
Any such resulting corrosion damage may involve the loss of coolant and, subsequently, cause considerable damage to the engine.

Warning

The coolant additive and the coolant present a health hazard!
The coolant additive must therefore be stored in a particularly safe place out of reach of children. If the coolant must be drained, it must be caught and also stored in a safe place.

Drained coolant should normally not be reused; it must be disposed of under observance of the applicable environmental protection regulations.

Checking coolant level

The coolant level can only be properly checked with the engine stopped.

The right coolant level is important for the proper operation of the cooling system. Therefore, the coolant level should be checked regularly. **With the engine cold, the coolant must be above the min mark and below the max mark** (see fig. above).

Note

The coolant level is measured using a sensor. If the coolant level is too low, then this is displayed in the multifunction display and an acoustic warning tone is sounded.

Visual inspection

Check the coolant hoses for leaks and porosity.

When operating the engine in the tropics, the notes on page 56 must also be observed!

Warning

- **Never open the engine compartment cover when you see water vapour or coolant escaping from the engine compartment - risk of scalding! Wait until water vapour or coolant no longer escapes.**
- **Do not open the cooling system cap while the engine is hot - danger of scalding: The coolant system is pressurised!**
- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**

Coolant top-up

Use only new coolant for topping up.

First stop the engine and allow to cool.

Then cover the cap with a cloth and carefully unscrew in an anti-clockwise direction.

If no **G12++** or an additive with the specification **TL 774-F (N 052 774 F0** see label on container, bottle or drum) is available, no other coolant additive should be used. In this case only use water and restore the proper mixing ratio with the specified coolant additive (see page 39) as soon as possible.

In case of a major loss of coolant, only add coolant with the engine cooled down to prevent engine damage.

Never fill the system above the max. mark:

Excess coolant is forced out of the cooling system when it heats up by the overpressure valve in the cap!

Screw the cap firmly on.

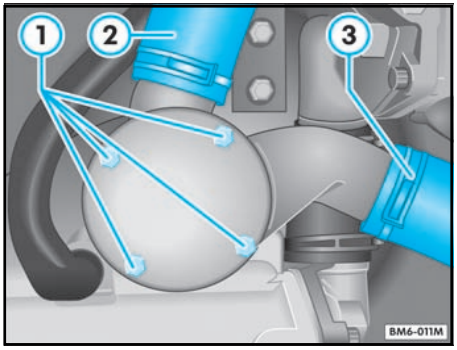
Important note

Please observe the following when topping up:

G12++ can be mixed with G13 at any ratio. Mixing with any other coolant additives must be avoided as this would deteriorate the corrosion protection and affect service life.
G12++ is violet. If the fluid shows any other colour, then G12++ has been mixed with another coolant additive!
In this case be sure to change the coolant as soon as possible!

If this is not done, severe engine damage or malfunction may result!

Seawater pump impeller checking and replacement where necessary



Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

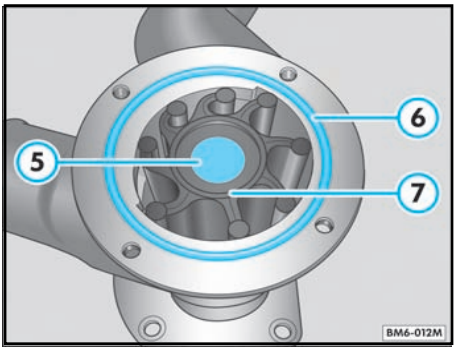
In accordance with the specifications in the service schedule, the impeller must be checked and replaced if necessary.

Note

- Close the seawater valve.
- Remove the screws **-1-** (see figure above)- on the front side of the seawater pump and take off the cover.
- Mark the direction of rotation of the impeller **-7-** (see fig. **BM6-012M**) and remove the rubber seal **-5-** from the middle of the impeller.
- Pull the impeller downwards off the shaft with a suitable puller.
- Check the impeller for damage.

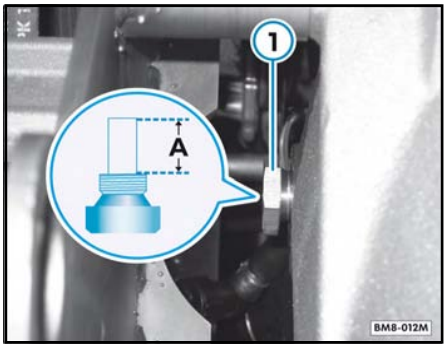
Notes

- The impeller must always be replaced, even if there is only minor damage.
- Make sure you always have a reserve impeller on board.



- Before reinstalling the impeller, grease it with silicone spray or glycerine.
- Push the impeller onto the shaft and press the rubber protection cap into the impeller.
- Replace the housing sealing ring **-6-** (see fig. above).
- Replace the cover on the housing and screw the screws **-1-** (see fig. **BM6-011M**)) back in.
- Open the seawater valve.
- Start the engine and check the cooling system for leaks.

Checking sacrificial anode and replacement if necessary



The sacrificial anode in the cooling system must be checked in accordance with the specifications in the service schedule and replaced if necessary.

Check the sacrificial anode, as it protects the engine from galvanic corrosion.

- Close the seawater valve.
- Screw out the sacrificial anode.

Note

The reactive anode is located at the back of the intercooler (see illustration above).

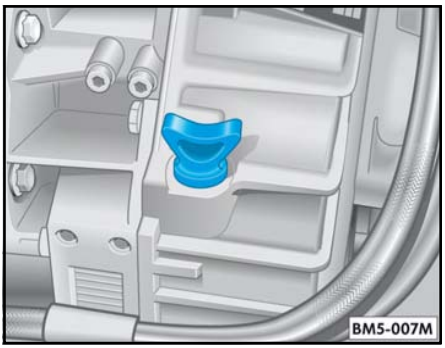
- Capture any escaping water (approx. 2-2.5 l) with a suitable container.
- After checking, screw the sacrificial anode back in.
- Open the seawater valve.

A new sacrificial anode has a length of dimension A = 20 millimetres - see figure.

The anode must be replaced with a new one when more than 50 % (10 millimetres) of it has been used.

Use only original VOLKSWAGEN Marine parts, as an incorrect composition of the anode can result in serious corrosion damage to the engine.

Reverse gearbox oil level checking



Warning

Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Note

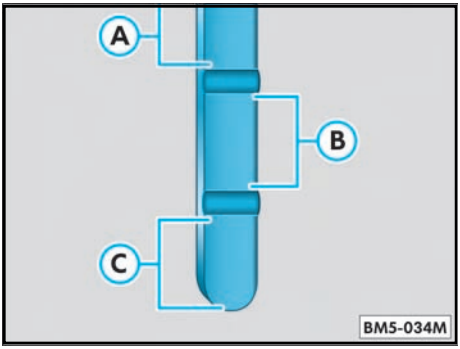
The oil of a reverse gear engine must be changed according to the instructions provided by the respective gear manufacturer. With every oil change, the filter element must also be replaced. Please make sure that you always follow the instructions provided in the operation manual of the manufacturer.

In order to properly check the oil level, the boat must be lying calmly. After switching off the engine, wait a few minutes to permit the oil to run back into the oil pan. The oil level can be checked either hot or cold.

Warning

Maintenance work on the gearbox has to be carried out only with engine switched off. Always wear gloves when working on a hot gearbox.

Reverse gearbox oil level checking



Sequence of work

1. Remove the dipstick by rotating its grip anticlockwise (see fig. BM5-007, p. 46) before withdrawing the dipstick from the housing.
2. Wipe the dipstick off with a clean and dust-free cloth ensuring all oil is removed.
3. Insert the dipstick back into the hole of the housing, making sure that you push it down to the end without screwing it in because otherwise the reading of the oil level will not be correct.
4. Then pull out the dipstick again and read off the oil level:

A- If the oil level is within range **-A-, no oil should be added.**

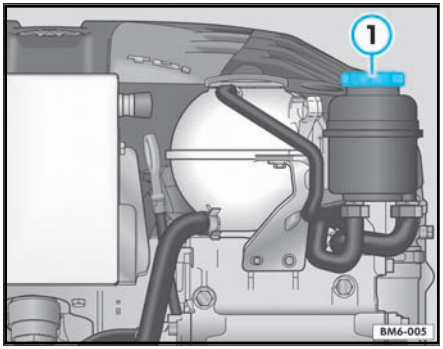
B- If the oil level is within the range **-B-, oil may be added.**
When doing so, the oil level may end up in range **-A-**.

C - If the oil level is within the range **-C-** or below, **oil must be added**. There is sufficient oil when the oil level is within range **-B-**.

However, the oil level must never be above range -A-.

In the case of heavy gearbox loading, such as during longer engine operation (10 - 12 hours), the oil level should at least lie in the middle of the two markings (min/max).

Hydraulic power steering oil level checking (only Z-drive)



Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

You should not leave the steering wheel at lock for longer than 15 seconds with the engine running. The hydraulic oil heats up considerably when the wheel is continually at full lock.

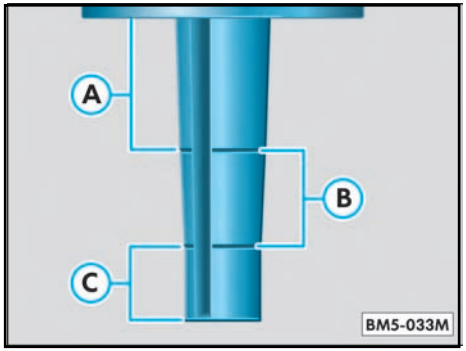
The power assisted steering system could be damaged as a result.

Noise also indicates the fact that the wheel is in the steering lock position while the boat is stationary, as the servo pump is heavily loaded in the process. It will also briefly reduce the idling speed of the engine.

The power-steering hydraulic oil level must be checked at regular intervals.

This test must be conducted with the engine running and the rudder in the straight-ahead position.

Hydraulic power steering oil level checking (only Sterndrive)



Screw out the oil dipstick **-1-**, wipe with a clean cloth and screw in the dipstick again up to the stop.

Then screw out the dipstick again and read off the oil level:

A - If the oil level is within range **A, no oil should be added.**

B - If the oil level is within range **B, oil may be added**.
When doing so, the oil level may end up in range **A**.

C - If the oil level is within the range **C** or below, **oil must be added**. There is sufficient oil when the oil level is within range **B**.

In the case of heavy steering loading, such as during longer operation (10 - 12 hours), the oil level should at least lie in the middle of the two markings (min/max).

Power-steering hydraulic oil renewal

The power-steering hydraulic oil must be changed in accordance with the specifications of the respective manufacturer.

Checking the ribbed V-belt and toothed belt

Warning

- **The ribbed V-belt and the toothed belt should only be checked or replaced with the engine stopped - risk of injury!**
- **Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.**

Check the ribbed V-belt and toothed belt for wear, separations and cracks.

Ribbed V-belts and toothed belts in poor condition must be replaced.

If you are not sure whether the ribbed V-belt or toothed belt is damaged, please contact a VOLKSWAGEN Marine Service Partner.

Note

It is always advisable to keep a replacement ribbed V-belt and toothed belt on board.

Battery - Warnings and safety precautions

Warning

The following warnings and safety precautions must be observed when working on the battery.

Wear eye protection. Do not allow acidic or lead-containing particles to get into the eyes or on to the skin or clothing.

Battery acid has a highly corrosive. Wear protective gloves and eye protection. Do not tilt the battery as acid may escape from the ventilation openings.

Flush the eyes with clean water for several minutes if acid splashes into them. Then seek medical assistance immediately. Immediately neutralize any acid splashes on the skin or clothing with soap suds and then rinse off with lots of water. If acid is swallowed, seek medical assistance immediately.

During battery charging, a highly-explosive gas mixture is generated.

Fire, sparks, naked flames and smoking are forbidden. Avoid spark formation when handling cables and electrical devices. Prevent short circuits. Never short circuit battery poles. Risk of injury due to high-energy sparks.

Keep acid and batteries away from children.

- **Always switch off the engine, the ignition and all electrical consumers and press the Stop button before working on the electrical system. The negative cable must be disconnected at the battery.**

- **When disconnecting the battery, first disconnect the negative cable and then the positive cable.**

The battery should not be disconnected with the engine running or with the ignition switched on, as otherwise the electrical system (electronic components) will be damaged.

- **When reconnecting the battery, first connect the positive cable and then the negative cable. The connection cables must never be swapped over - risk of electrical cable fire!**

Do not connect the battery with the ignition switched on or with the engine running, as otherwise the electrical system (electronic components) can be damaged.

To protect the case from UV radiation, do not place the battery in direct daylight.

***** Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines

Battery*

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Recommended starter battery

Nominal voltage: 12V
Cold starting power: 520A
Capacity: 110Ah

Cable diameters

50 mm^2

Battery* checking

Acid level

Please observe the warnings on the previous page.

The battery is virtually maintenance-free under normal operating conditions. However, at high outside temperatures or with long, daily operating hours it is advisable to check the acid level from time to time. Similarly, the acid level must also be checked after each charging process. Add distilled water if necessary up to the acid level marking or up to a level 5 mm above the separators.

Charging state

Determine the battery charging state by checking the acid density or the battery voltage.

Acid density (specific gravity)
charged = 1.285,
discharged = 1.12

Total voltage

Determine the total voltage only by connecting a voltage tester to the battery:

- test duration: 5 to 10 seconds
- nominal voltage: 12 Volt
- discharged: 9.6 Volt.

Battery terminals

Clean and grease terminals and note external condition of battery, e.g. raised plates, cracked case.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines.

Battery* without magic eye

The acid level is always to be at the **max.** mark on the long side. Never fill above the **max.** mark and do not allow the acid level to drop below the **min.** mark.

The concerned battery cells must be filled up to the **max.**- mark before the acid level reaches the **min.**- mark.

Do not overfill the battery cells, as otherwise battery acid will escape via the vent opening. This can lead to injury and corrosion damage.

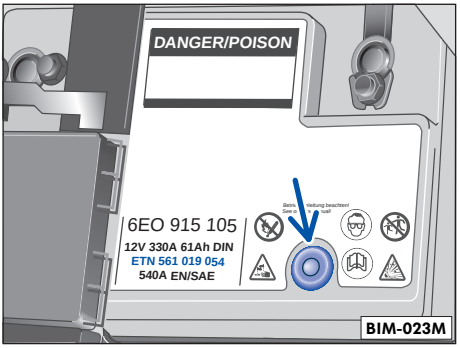
After filling, the battery cells affected must be sealed tightly with the battery plugs.

We recommend having the acid level checked and corrected by a VOLKSWAGEN Marine Service Partner.

Note

The use of gel batteries on board is recommended.

Battery* with magic eye



A round inspection window (see arrow) is provided on top of the battery. This "magic eye" changes its colour depending on the charging state and acid level of the battery. The colour display serves VOLKSWAGEN Marine Service Partners as a diagnostic aid.

Air bubbles can falsify the colour display. Carefully tap the magic eye.

If the indication in the inspection window is **colourless or light yellow**, the battery level is too low. Distilled water must be added. With batteries older than 5 years we recommend replacement.

We recommend having the acid level checked and corrected by a VOLKSWAGEN Marine Service Partner.

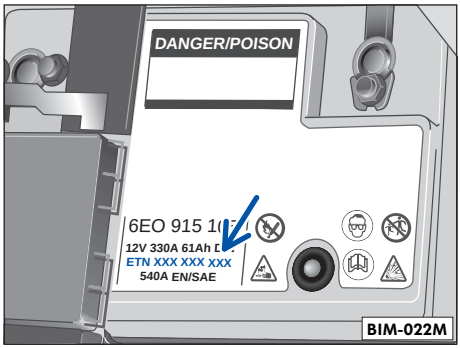
Battery removal

Before removing the battery, switch off the ignition and all current consumers.

To remove the battery, first disconnect the negative cable (usually black or brown) and then the positive cable (usually red). Then unscrew the battery mounting.

* Does not form part of the standard scope of supply for VOLKSWAGEN Marine boat engines.

Battery* with magic eye



Battery replacement

If the battery is replaced, the new battery must have the same voltage (12 V), design and safety characteristics such as central venting and an O-ring seal for the battery plugs.

The amperage and capacity should match. VOLKSWAGEN Marine Service Partner offer a range of suitable batteries.

When installing the battery, make sure that the ignition and all current consumers are switched off.

Due to the disposal problem regarding used batteries, it is best to have a battery replaced by a VOLKSWAGEN Marine Service Partner. Batteries contain sulphuric acid, lead etc and should never be disposed of in household refuse.

Battery connection

Before connecting the battery, switch off the ignition and all current consumers.

Place the battery in the installation location provided and secure the battery with the battery bracket.

To connect the battery, first connect the positive cable (usually red) and then the negative cable (usually black or brown).

Battery charging

Warning

Observe the warnings on page 48 and the information provided by the charger manufacturer.

Note

To charge the battery of the on-board electrical system, the use of special boat chargers that prevent gassing of the battery is recommended.

Warning

- **Keep children away from the battery, battery acid and the charger.**
- **Only charge the battery in a well ventilated area. Do not smoke or use naked flames and ensure no electrical sparks are produced when charging batteries, as a highly explosive mixture of gases is given off during battery charging.**
- **Protect your eyes and face. Do not bend over the battery.**
- **Rinse battery acid from eyes or skin immediately for several minutes with clear water. Then seek medical care immediately.**
- **Quick charging of a battery is dangerous and should only be carried out by a VOLKSWAGEN Marine Service Partner, as special chargers and knowledge are required.**
- **Never charge a frozen battery - risk of explosion! A discharged battery can freeze at temperatures just less than 0 °C. A frozen battery must always be allowed to thaw prior to charging.**

We do not recommend the continued use of thawed batteries, as the battery housing can be cracked by the formation of ice and battery acid can leak out as a result.

Engine test run

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Warning lamps

Check the warning lamps for the coolant, the alternator and the engine oil pressure. The warning lamps light up when the engine is shifted into the operating position and must go out again after the engine is started.

Starting the engine

Check the starting behaviour of the engine when doing so.

Leaks

Check the cylinder head cover, oil filter, fuel system and cooling system for leaks.

Exhaust system

Check the exhaust system for leaks and damage.

Engine preservation

Engine oil and the oil filter element renewal (see page 35 and 36).

For units to be shut down for longer periods - e.g. after the end of the season - please carry out preservation in the specified order:

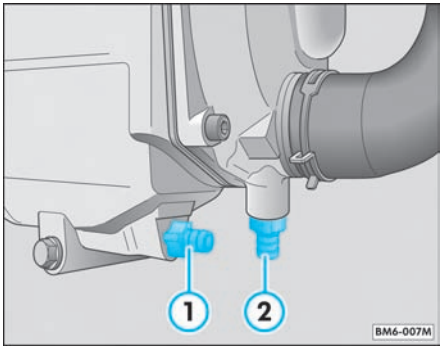
1 - Thoroughly clean all parts to be preserved.
2 - Allow the engine to warm up.
3 - After switching off the engine, replace the oil filter element and pump off the motor oil - see page 36 and 37.
4 - Add engine oil and run the engine for approximately 30 seconds at a high idling speed.
5 - Switch the engine off.
6 - Plug all openings (e.g. exhaust pipe, air filter) to prevent the penetration of dirt or moist air.
7 - Spray the engine with an anti-corrosion agent from the outside.

Note

On engines that run at least 20 minutes under load every two weeks, no corrosion protection is required. However, the oil must be changed at the intervals specified in the service schedule.

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Seawater cooling system flushing and draining



Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Flushing and subsequent draining of the seawater cooling system with fresh water is very important for preventing corrosion and frost damage.

The flushing process should be carried out together with the engine oil change.

Conduct flushing in the specified order:

1 - Close the seawater valve **-1-**.

2 - Open and clean the seawater filter -see page **42**.

3 - Fill the seawater filter with fresh water and run the engine at idle.

Make sure that the seawater filter is always filled with fresh water to prevent the seawater pump from running dry. This would result in the pump becoming defective.

It is important that the engine runs for a while so that all sludge and salt residues are flushed away that could otherwise promote corrosion.

4 - Switch off the engine again.

5 - Screw on the cover of the seawater filter.

6 - Push a suitable hose onto the connection of the drain screw **-2-**.

7 - Open the drain screw, to which you have connected the hose, and capture the water in a suitable container.

8 - After completing draining, remove the hose from the drain screw and close the two drain screws again.

Bleeding the fuel system

Note

There is a possibility that the engine will not start if the fuel system of the boat has not yet been completely bled. Make sure to properly bleed the fuel system in order to avoid engine starting problems.

The fuel system can be bled as follows:

1. First make sure that the fuel filter is filled with fuel.

2. Remove the pressure sensor from the back part of the left “rail” in order to open the “rail” and allow the entrapped air to escape.

3. Start the engine and let it run for approx. 20 - 30 seconds.

4. Wait a few seconds and repeat the above procedure two more times. Now the fuel system of the boat should be properly bled.

5. Attach the pressure sensor to the back part of the left “rail”.

6. Start the engine.

Winter operation

At the end of the season, the fuel system also requires maintenance and inspection.

Please observe the following:

- To prevent condensation water in the tank, completely fill the tank before the end of the season.
- Check the fuel system for leaks.
- Drain water from the circulation filter - see page 38.
- Replace the fine element fuel filter - see page 40.
- An inspection service should always be conducted on the VOLKSWAGEN Marine boat engine before the start of the cold season. In addition, please observe the following instructions when operating the VOLKSWAGEN Marine boat engine at extremely low temperatures.

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Battery

The battery capacity decreases as the temperature drops. This is due to its chemical and physical properties. This is why an extremely cold battery, which is also not well charged, only has a fraction of the starting power it has at normal temperatures.

We recommend recharging the battery every 6 to 8 weeks in the winter. The acid level and density must be checked. The voltage of the cells must be measured with the battery loaded.
It is best to have this work conducted by a VOLKSWAGEN Marine Service Partner.

Winter operation

If the engine is not used for several weeks at extremely low sub-zero temperatures, the battery should be removed and stored in a frost-proof room to prevent it from freezing and being destroyed.

Cable connections

Check and clean all cable connections, as oxidised connections lead to voltage drops and starting difficulties.

Cooling system

(please observe the notes on page 43)

Tropical operation

To protect the engine against heat, dust and corrosion, the following measures are required:

Warning
Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

Engine

If the unit is not operated for a longer period, the engine should be protected against possible corrosion damage.
See the chapter "Engine preservation".

Battery

Check the battery acid level above the upper edge of the plates weekly. It is approx. 5 mm or can be read off at the existing acid level marks. In case of losses due to evaporation, only distilled water should be added.
Observe the instructions about this on page 49.

Air filter

If the engine is to be operated in very dusty areas, check the filter element more frequently.
Observe the instructions about this on page 42.

Cooling system

The coolant level must be checked daily. If a coolant loss is detected, the cooling system must be checked for leaks, as normally coolant losses hardly occur in the closed cooling system.
Observe the instructions on the pages 9, 43 and 54.

Fine element fuel filter

Drain the water from the filter weekly.
The fine element fuel filter should be changed earlier than specified in the service schedule if necessary.
Observe the instructions on pages 39 and 40.

TDI 350-8 Diesel Engine with 2 exhaust-gas turbochargers

Engine data		
Engine code		**CEMA**
Output	*at rpm*	257 kW (350 bhp) / 4200
Maximum torque	*in Nm at rpm*	700 / 2000 - 3250
Number of cylinders, displacement		8 cylinder, 4.134 cm^3
Compression		16.4
Bore/stroke	in mm	83.0 / 95.5
Turbocharging		2 exhaust-gas turbochargers VTG[2)]
Charge-air cooling		Seawater- pipe-bundle heat exchanger
Weight	in kg[1)]	368
Efficiency weight	in kg/bhp[4)]	1.05
Diesel fuel		at least CN 51 as per DIN EN 590
Complies with the following emission legislation Certificate No. as per BSO 2		EG 2003/44 M1 03 3 08 04
Fuel consumption		
Min. specific	*in g/kWh*	215
Filling quantities		
Coolant	*in litres*	approx. 9.0 G12+ +
Hydraulic oil Power steering	*in litres*	approx. 1.0 ATF
Dependent on reverse gearbox model	*in litres*	approx. 2.5 - 3.5
Engine oil[3)] with filter change The oil level must be checked when topping up. **Do not overfill!**	*in litres*	9.0
VOLKSWAGEN Longlife oil	*Specification*	VW 504 00 und 507 00

1) The weight corresponds to a dry engine, with ancillary units, cooling system and clutch flange.

2) Turbocharger with variable turbine geometry

3) For additional information see "Engine oil" on page 35.

4) Weight specification based on output, in order to compare engines with different sizes and output relative to their efficiency.

Engine characteristic data

Important note

Please always specify the model with the engine number or the engine code when making all queries, any complaints and when ordering spare parts.

This will prevent misunderstanding when processing your query.

Before you read of the characteristic data, stop the engine and allow it to cool down.

Warning

Observe the safety precautions beginning on page 17 before performing any work on the engine or in the engine compartment.

The name plate

The name plate is located to the front on the intercooler.

Engine code
Engine number

The engine code is a series of four letters (e.g. CEMA), which is followed by the engine number, a six-digit number. The engine code and the engine number are punched into the left side of the cylinder block.
In addition to this, they are shown on the nameplate.

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